Need/Opportunity Title: Long-Term Management of Void Space, Containers, and Cover Subsidence of Disposed Waste
Need/Opportunity ID No: NV11-0001- 08
Date:
Need/Opportunity Description: Subsidence of waste disposal cells over time frames of hundreds of years is expected. It will occur because of the collapse of void space within and between containers, and because of the degradation/compaction of containers and the waste within them. Methods need to be developed to better predict the dynamics of collapse of void space, container/waste form degradation, and subsidence of cap materials. Current subsidence models used in the performance assessment studies of the radioactive waste management sites assume maximum subsidence. An increased understanding of the dynamics of subsidence would lead to more realistic estimations of the magnitude and timing of subsidence. Additionally, if subsidence can be accelerated during the period of institutional control (100 to 250 years), its effect on closure cap covers of waste cells can be mitigated through periodic maintenance.
Need/Opportunity Category: Technology Need
Operations/Field Office: DOE/NV
Site: Nevada Test Site (NTS)
End User Program: Waste Management Division (WMD)
Priority Rankings:
End User Program Ranking: 3 of 3
ACPC Priority: 2
Site Wide Ranking: 7 of 13
PBS Number/Title: NV370/Low-level Waste (LLW)
WBS Number: 1.3.5.2.1
Waste Stream: Cotter Concentrate Trash and PPE (01040) and WEF LLW (NTS) (3151)
Background: Subsidence of waste and the closure cap of waste cells will occur over periods of hundreds of years. The dynamics of such subsidence is poorly constrained. Accelerated subsidence during the interval of institutional control can be mitigated through site maintenance.
"Baseline" Technology/Process: Normal disposal of containerized waste and bulk waste is the current technology used.
Cost: The conceptual cost is $40 million in present day dollars. This cost will be updated as more information becomes available.
How Long Will it Take: One hundred years after closing the waste cell.
Issues Related to Baseline:
Technical: Differential subsidence of waste cells will produce depressions in the closure cap above the waste and these depressions can pond water from run on resulting in increased moisture infiltration and increased growth of plants whose roots can penetrate the waste and create releases through preferential uptake of radionuclides. Subsidence of the closure cap can thin and fracture the cap resulting in increased upward releases of gaseous radionuclides. Because tritium is the dominant waste radionuclide in the waste cells, an effective program of combined accelerated subsidence and closure cap maintenance would eliminate subsidence as

performance assessment or stakeholder concern.

Cost: The cost savings is estimated to be on the order of $12 million over a 100-year period in present day dollars.

Regulatory: Not applicable.

Safety, Health, and the Environment: Reduction in subsidence will result in a greater margin of protection of public health and safety relative to the performance objectives of DOE Order 5820.2A.

Stakeholder and Cultural: Potential contamination of groundwater resources or direct radiological releases to the atmosphere are demonstrated release pathways.

Other: Not applicable.

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Functional Performance Requirements: One requirement is to measure and develop predictive models of the processes of subsidence including void space collapse, collapse of cap materials, and degradation and collapse of waste forms. A second requirement is to assess viable processes that could be proposed to accelerate subsidence during the institutional control period of waste cells. There are a range of processes that have been used or proposed to accelerate or mitigate subsidence including overloading of waste cells by placing loads on the operational cap covering waste cells, forced compaction using rapidly applied external forces, use of easily degradable or collapsible waste containers, and accelerated decomposition of containers/waste forms through introduction of corrosive fluids or biological/bacterial factors. However, DOE/NV is funding ongoing work on bio-degradation of waste containers through the Nevada Environmental Research Park program. These mitigation options described are judged currently not to be viable because they are too expensive in comparison to the cost of construction of a thick alluvial closure cap, although there are also circumstances under which subsidence can occur for this type of cover too. The one possible exception is the use of biological/bacterial factors to accelerate container degradation. In December 1998, DOE/NV issued an informal expert judgment report on subsidence mitigation options.

Schedule Requirements: Disposal of low-level waste is ongoing. Predictions of the dynamics of subsidence and options for accelerating it need to be completed within the schedule of the accelerated cleanup (2006) and prior to operational closure of the waste disposal sites.

Consequences of Not Filling Need/Opportunity: There will be an increased concern about the viability of long-term storage of disposed radioactive waste. Enhanced costs for more robust caps, increased closure cap maintenance, and vadose zone monitoring may be required without

these studies.

Contractor End User Point(s) of Contact: David Shafer, Desert Research Institute, Technical Support, Office: 702-895-0564, Fax: 702-895-0427, E-mail: dshafer@dri.edu; Ed Hohman, Bechtel Nevada, Technical Support, Office: 702-295-3798, Fax: 702-295-1420, E-mail: hohmaneh@nv.doe.gov

DOE End User Point(s) of Contact: Kevin Leary, WMD, Technology Facilitator, 702-295-0184, Fax: 702-295-1153; E-mail: leary@nv.doe.gov

*New need number: "NV04" = Nevada need #4; "0001" = FY2000 version #1; "5"=Priority; "S"= Science Need